Personality and adherence to medication treatment

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“*Quod scripsi scripsi*”

Abbreviations

ACT	Asthma Control Test
BMI	Body mass index
FFM	Five-Factor Model
FFT	Five-Factor Theory
GINA	Global Initiative for Asthma
GSE	General Self-Efficacy
GT	Grounded Theory
HP5i	Health-relevant Personality 5 factor inventory
HRQL	Health-related quality of life
ICS	Inhaled corticosteroids
LABA	Long-acting β_2-agonists
MARS	Medication Adherence Report Scale
MCS	Mental component score
PCS	Physical component score
SABA	Short-acting β_2-agonists
SF-8	Short Form-8 Health Survey
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization

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Introduction

State of the art

People are a ‘motley crew’ in terms of their individual differences, and these differences may partly be explained by the diversity in personality dispositions. Personality constitutes *“psychological qualities that contribute to an individual’s enduring and distinctive patterns of feeling, thinking and behaving”* (p. 8),[1] which implies that our personalities are fairly consistent across time and situation and make us different from each other. Several personality theories exist, but one that has attracted attention in recent decades is a trait theory called the five-factor theory of personality, which encompasses five broad and bipolar personality traits: Neuroticism, Extraversion, Openness to experience, Agreeableness and Conscientiousness.[1] People are characterized by the degree to which they show these five personality traits in their thoughts, feelings and behaviour.[2] As regards health behaviour, research has shown associations between the described personality traits and adherence behaviour, such as adherence to medication treatment.[3] Because the significance of personality as an influential factor in adherence behaviour has not been sufficiently explored, meaning that no conclusions can be drawn as yet,[4] and because adherence to long-term medication treatments is regarded as too low in general,[5] adherence behaviour in relation to personality constitutes the main focus of the present thesis.

Background

The five-factor theory

The five-factor theory (FFT) has its origin in studies of personality traits, but seeks to explain the complex interaction between the enduring and changing parts of the personality. The core of the FFT constitutes the Basic Tendencies and the Characteristic Adaptations and the distinction between them. The FFT serves as an overview of a personality system, where complex undefined dynamic processes regulate the components in the theory. These processes could constitute perceptions, coping or planning, but are not specified in the FFT.[2] According to the originators, Costa and McCrae,[2] knowledge from several fields is required to fully explain these complex processes.

The personality traits – Neuroticism, Extraversion, Openness to experience, Agreeableness and Conscientiousness – could be described as endogenous Basic Tendencies that, according to the FFT, are biologically based and therefore rather stable in adulthood. The basic assumption of this position is that the Basic Tendencies would be more unstable across time if they were environmentally influenced.[2]

In contrast, the Characteristic Adaptations, which are said to be the most complex part of the personality system, are plastic, environmentally acquired structures, such as beliefs, attitudes, interests and habits, but also social roles and interpersonal interactions. These structures change with biological maturation, surrounding context or as a consequence of deliberate interventions, although some structures are rather constant while others are more volatile. The Characteristic Adaptations also refer to the ability to respond to the context in terms of adaptation of feelings, thoughts, and behaviour in line with personality traits and previous adaptations. External influences like cultural norms or life events influence the Characteristic Adaptations, which means that there is an ongoing interplay between the environment and personality traits that shapes the

Characteristic Adaptations and regulates behaviour. There is also a mutual interaction between the person and the environment, as people interpret and influence the environment in a manner consistent with their personality dispositions.[2]

The Self-Concept is in fact a part of the Characteristic Adaptations, but is of such significance that it needs special attention. It contains our understanding of ourselves in terms of our view of our own personality and identity. People tend to structure their Self-Concept in a life narrative as a way of making their life meaningful and unified. The Self-Concept is said to change in line with changes in personality traits and social roles.[2]

If biological bases and external influences are inputs, then Objective Biography is the output or mirror reflecting people's thoughts, feelings and behaviour during the life course.[2]

The five-factor model

The FFT is built on research on the five-factor model of personality (FFM) focusing on stability in personality traits. The FFM, also known as the Big Five, represents a hierarchical structure of traits that consists of five broad bipolar personality dimensions called Neuroticism, Extraversion, Openness to experience, Agreeableness and Conscientiousness, which represent the highest hierarchical level.[2] Each dimension consists of six facet scales that are defined by clusters of interrelated specific traits,[6] as illustrated in Table 1.

Table 1. The personality traits including facet scales.[6]

Neuroticism	**Extraversion**	**Openness to experience**	**Agreeableness**	**Conscientiousness**
Anxiety	Warmth	Fantasy	Trust	Competence
Hostility	Gregariousness	Aesthetics	Straightforwardness	Order
Depression	Assertiveness	Feelings	Altruism	Dutifulness
Self-consciousness	Activity	Actions	Compliance	Achievement striving
Impulsiveness	Excitement-seeking	Ideas	Modesty	Self-discipline
Vulnerability to stress	Positive emotions	Values	Tender- mindedness	Deliberation

The FFM has its origin in the so-called lexical hypothesis. The idea is that descriptions of personality in terms of traits have been encoded in the natural languages by laypersons for years and years. The advantage of constructing a theory based on the descriptions of individual differences from the natural language is that the descriptions can also be understood by people in general. As a language contains a considerable amount of personality descriptions, a statistical method called factor analysis has been used to organize these descriptions into groups of synonyms, which in turn could evolve into clusters and eventually into broad personality factors.[7] Factor analysis could be described as a method for data reduction, which means that a large number of interrelated variables (for instance personality descriptions in a language) could be collapsed into a smaller set of linear combinations called factors. In this way, a meaningful structure in the large number of correlations is identified and a smaller number of factors are found, which cover or summarize the inter-correlations among a large number of variables.[8] The contemporary FFM is based on the questionnaire tradition, which means that the FFM personality traits have been identified, singly or in combination, in other personality instruments.[7]

According to the FFM, the personality traits are influenced by biology to a greater extent than by life experiences. Until the age of 30, there is a decline in Neuroticism, Extraversion and Openness to experience, and similarly an increase in Agreeableness and Conscientiousness.[9] Thereafter, it is claimed that the personality traits remain rather stable, therefore shaping the characteristics of the person for years to come.[2] However, the described changing trend is said to continue even after 30 years of age, but at a much slower rate.[9] Moderate changes in the five personality traits after 30 years of age have recently been reported as follows: Neuroticism scores declined up to the age of 80; Extraversion scores were stable until the age of approximately 50 and thereafter a reduction was seen; scores on Openness to experience had a negative trend all along; scores on Agreeableness increased by age; there was an increase in Conscientiousness until 70 years of age.[10] The FFM personality traits appear and function quite similarly in different cultures,[11] and in both sexes, but women tend to score higher on Neuroticism and Agreeableness than men do. There are also some differences in facet scales, for instance women are more likely to score higher on Openness to Feelings, while men tend to score higher on Openness to Ideas.[12]

Neuroticism

Neuroticism measures degrees of emotional stability.[1] A person scoring high on this trait could perhaps be described as a *"worrying kind of person"* with difficulties handling stress and controlling his/her desires.[6] Higher scores on this trait have also been associated with less healthy behaviour estimated as wellness behaviours, such as exercise to stay healthy and healthy eating, less accident control, such as having a first aid kit, and more traffic risk-taking.[13] Fewer health habits measured in relation to smoking, alcohol and diet habits were practised in both men and women with higher scores on Neuroticism.[14] Current smoking has been related to higher scores on Neuroticism, especially with concurrent low scores on Conscientiousness.[15] In addition, Neuroticism may influence the perception of health, as higher scores have been associated with the perception of poor health in the absence of medical symptoms.[16] It has also been reported that people with high scores on this trait may be more attentive to physical symptoms and tend to interpret them as signs of illness,[17] which could result in frequent complaints of symptoms[17, 18] and recurrent health-care seeking.[17] People scoring low on Neuroticism could be characterized as emotionally stable, which entails that they are more likely to be even-tempered and able to face stressful situations calmly than are people with high scores.[6] Emotional stability has been associated with longevity.[19]

Extraversion

Extraversion estimates the quantity and intensity of interpersonal interaction,[1] and people scoring high on this trait are likely to enjoy socializing in large groups. They could also be described as talkative, optimistic and active.[6] In contrast, low scorers are more likely to prefer small settings or solitude and could be described as reserved and independent in disposition. Higher scores of Extraversion have been related to perceptions of good health despite the presence of medical problems.[16] Extraversion has also been related to health behaviour. For instance, women with high scores were associated with fewer healthy habits measured in relation to smoking, alcohol and diet habits than were low scorers.[14] Higher scores on this trait have also been related positively to accident control and wellness behaviour measured as exercising to stay healthy and diet restrictions.[13] It has been reported that higher scores on Extraversion measured in childhood were associated with both alcohol use[20] and smoking, but also with performing more physical activity in adulthood.[21]

Openness to experience

Openness to experience measures degrees of seeking and enjoyment of experiences for their own sake.[1] High scorers are more inclined to be open in disposition, to like new ideas and unconventional values than are low scorers. They may also be curious about the inner and outer world,[6] and high scores have been associated with risk-taking behaviour.[13] It has been reported that women scoring high on Openness to experience tend to have fewer healthy habits, measured in relation to, e.g., smoking, alcohol consumption and eating habits.[14] Low scorers tend to prefer the habitual to the new and to be conservative. Concerning emotions, low scorers on Openness to experience are more likely to be muted in disposition in contrast to high scorers, who are more likely to act out their feelings.[6]

Agreeableness

Agreeableness involves quality of interpersonal interaction,[1] and people associated with higher scores on this trait are inclined to be altruistic, sympathetic and helpful to others, with a preference for cooperation. People on the low end of this dimension may be egocentric, competitive and sceptical about other people's intentions.[6] Higher scores on Agreeableness have been associated with healthy behaviour such as more accident control and less traffic risk-taking,[13] but also serve as a predictor of a healthy lifestyle, such as less smoking, low alcohol consumption and healthy diets.[14] In contrast, people scoring low on Agreeableness in childhood seem more disposed to less healthy behaviour as adults in terms of higher alcohol consumption and, among women, smoking.[20]

Conscientiousness

Conscientiousness measures the degree of motivation in goal-directed behaviour.[1] Higher scores on Conscientiousness have been associated with characteristics such as being reliable, scrupulous and punctual, but in its extreme with fastidiousness, compulsive orderliness or workaholic behaviour. In comparison, people scoring low on this trait tend to be more relaxed when it comes to achieving goals and to be less organized and somewhat lazy.[6] Conscientiousness has been associated with health behaviour, such as better wellness behaviour, more accident control and less traffic risk-taking.[13] Higher scores on this trait have also been associated with a healthy lifestyle,[22] such as not smoking, healthy eating and engaging in physical activity.[14] Additionally, Conscientiousness has

been associated with longevity.[19, 23, 24] Conscientious children seem less inclined to be smokers and to have high alcohol consumption as adults.[23] In contrast, lower scores on Conscientiousness in childhood have been associated with smoking and poorer self-reported health in adulthood.[20]

Clinical use of the FFM

Clinical use of the FFM has primarily been related to psychotherapy. It has been claimed to be useful in that context, partly for achieving a better understanding of patients´ problems and partly for adapting treatment in line with specific needs.[25, 26] Furthermore, the FFM is suggested to improve our understanding of patients´ obstacles and possibilities and thereby to make predictions about treatment outcomes.[26, 27] It has also been proposed that matching different personality traits with different treatment approaches would result in better health outcomes.[28] Personality traits could also be useful when predicting health behaviours such as adherence to treatment. In this respect, personality traits could both give rise to an increased understanding of the behaviour and serve as a guide to identifying different types of needs when planning interventions.[6]

Perspectives on the FFM

One advantage of the FFM is that it provides a coherent and handy taxonomy of individual differences based on a strong foundation of objective data gathered in diverse samples, through both self-reports and observer ratings.[1] However, it has been argued that individual differences exist that are not covered by the FFM taxonomy. There are arguments stating that personality dispositions associated with honesty-humility have been overlooked. Therefore, the trait Honesty-humility has been suggested as the sixth personality trait.[29]

Other criticism is related to the so-called person-situation controversy, which proposes that there is an inconsistency in trait-related behaviour from situation to situation. A person could show behaviour congruent with high scores on one personality trait in one situation, but show incongruent behaviour on the same trait in another situation. For that reason, it has been suggested that the situation or context needs to be incorporated into the assessment of personality.[30]

The longitudinal stability in adulthood has also been questioned, and it has been reported that scores on Conscientiousness[31] and Agreeableness actually continue to increase with age.[31, 32] Another criticism is that the FFM does not include dynamic personality processes and is merely focused on population-based individual differences instead of individual-level differences.[1]

One strength of the FFM is its wide range of application as a way of assessing stable individual differences,[1] for instance in health research.[23, 33, 34] In regard to this type of research, the FFM has been described as advantageous because it does not include any health-related items that could interact with investigated health factors.[13] It has also been argued that the primary focus of the FFM is on descriptions of personality and not on explanations of associations between personality and health. In addition, the FFM does not include any clear cognitive perspective, as do social learning theories. For these reasons, it has been suggested that health research would be more comprehensive if it combined the FFM with other contemporary psychological theories and research.[35] From an integrative personality perspective, it has been said that an unmet need exists for a comprehensive personality theory, which could provide a holistic perspective on human personality. Hence, the idea of a new Big Five that incorporates personality traits in conjunction with human nature, culture, life narratives and characteristic adaptation has been introduced.[36]

Adherence

The concept

Compliance

The verb comply means to *"act in accordance with a wish or command"* and its etymological origin is the Latin word *"complere"*, which means to fulfil. The noun compliance means *"the action or fact of being compliant"* and the adjective compliant means *"disposed to agree with others or obey rules, especially to an excessive degree, acquiescent"* (p. 293).[37] Haynes[38] defined compliance as *"the extent to which a person's behaviour (in terms of taking medications, following diets, or executing lifestyle changes) coincides with medical or health advice"* (p. 1). Both these descriptions have a paternalistic undertone as to the relationship between a professional who prescribes expert advice and a dependent patient,[39] who is expected to passively and obediently follow it.[40] Because of this unequal relationship

and lack of consideration for patients' initiative, it has been proposed that compliance needs to be reconceptualized in favour of regarding the patient as an active partner in his/her own health care.[39]

Adherence

The concept of adherence has been launched as an alternative to compliance. It constitutes an attempt to highlight the fact that the patient is free to decide whether to adhere to the prescriber's recommendations and that a decision not to adhere should not result in blaming the patient. The concept "adherence" develops the definition of compliance by emphasizing the need for an agreement between the prescriber and the patient.[41] The definition of adherence used by the World Health Organization (WHO) is, *"the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes – corresponds with agreed recommendations"* (p. 3).[5]

It has been claimed that no semantic difference exists between the two concepts compliance and adherence, although adherence is supposed to include a negotiation between the patient and the prescriber.[42] The etymological origin of the verb adhere is the Latin *"adhaerere"*, which means *"to stick"* and to adhere means *"stick fast to, believe in and follow the practices, represent truthfully and in detail"*. The noun adherent is *"someone who supports a particular party, person, or set of ideas"* and the adjective means *"sticking fast to something"* (p. 16).[37] A concept analysis of adherence reported that the concepts adherence and compliance were used interchangeably in the literature. It was also reported that different definitions of adherence existed, but none included a patient-centred approach characterized by taking the patient context into consideration, and that the potential power imbalance between the patient and the prescriber was disregarded.[43]

Concordance

The etymological origin of concordance is the Latin word *"concordant, concordare"*, which means to *"agree on"* and its semantic meaning today is *"agreement or consistency"* (p. 297).[37] In the context of following medication prescriptions, the concept was first coined by Marinker et al.,[44] as a result of a collaboration between representatives in a working party

from the Royal Pharmaceutical Society of Great Britain and patients' organizations and their effort to act on non-adherence. In this context, the idea of a new form of therapeutic relation between patients and physicians was born – *concordance*. The aim of this concept is *"to optimise health gain from the best use of medicines, compatible with what the patient desires and is capable of achieving"* (p. 12).[42] The basic idea is that the meeting between the patient and the prescriber is like a meeting between two sets of equally important health beliefs. The patient's task is to describe his/her beliefs and the prescriber's is to make these beliefs possible. The prescriber's task is to describe his/her beliefs from a professional point of view and the patient's is to consider these. This strategy is intended to guide patients in making informed choices, as regards their diagnosis and treatment. Concordance recommends a mutual relation between the patient and the prescriber, in which the patient makes the decision. It is emphasized that concordance does not mean that scientific evidence should be disregarded.[42]

The behaviour

Adherence behaviour has historic wings. Perhaps the first and most famous description of adherence behaviour stems from the Judeo-Christian tradition, when Eve ate the apple from the tree of knowledge in the Garden of Eden, despite having been advised not to. In ancient Greece, Hippocrates realized that patients did not always follow treatment recommendations.[38] Today adherence is a well-studied health behaviour, but perhaps the least well understood. Despite decades of research, the dilemma of insufficient adherence to prescribed treatment in relation to chronic disease still remains, and much is left to be learnt.[40, 45] It is common knowledge that adherence to long-term medication treatment in chronic disease is unsatisfactorily low. It is estimated that adherence to prescribed treatment in developed countries is 50%, but even lower in developing countries.[5]

The WHO recognizes insufficient adherence as a substantial problem and states that improving adherence would have a more beneficial impact on health outcomes than would the improvement of specific treatments.[5] Deviating from a prescribed treatment may mean that an expected effect will fail to appear, with risk for consequences such as worsening of the health condition or inability to evaluate the effectiveness of the treatment.[40] Insufficient adherence may be described as a chain reaction, where poor adherence to prescribed treatment leads to unmet treatment expectations[5]

with inadequate disease control as a consequence,[46-50] which in turn could lead to both direct costs related to an increase in utilization of health care[51, 52] and indirect costs related to the person, such as impaired functioning and disability[53] and a reduction in productivity.[40] Even so, striving for enhancing medication adherence could be regarded as working with patient safety in terms of minimizing the risk for negative consequences of suboptimal adherence, such as increased risk for severe relapse, dependency, or a rebound effect.[5]

Factors influencing adherence behaviour

Thanks to the large body of research published during recent decades, several factors have been identified with regard to their influence on adherence behaviour. Thus far, it has been difficult to conclude which factors are of most significance and how these interact in influencing adherence behaviour.[40] WHO has structured recognized influential factors into five dimensions: social/economic, therapy-related, patient-related, condition-related and those related to the health-care team and system.[5]

The influence of social/economic factors could pose challenges to treatment adherence,[5, 54] but their effect on adherence shows an inconsistent pattern[5] and seems to vary by sample.[55] Low level of education, unemployment, unstable living conditions are some factors that[5] together with low income could constitute a risk for low adherence[5, 53] in terms of unfilled prescriptions or intake of lower doses than prescribed in order to economize.[53] Nevertheless, the opposite situations are also seen, as low adherence to medication treatment does occur among people with a high income and high adherence occurs among people with a low income.[53] Another aspect is older adults who may have limited economic resources to remain in a treatment due to the reductions in income that come with retirement.[54] Note that older adults are the highest consumers of medication due to the prevalence of multiple chronic diseases in this group.[5] WHO states that low adherence is found in all age groups and that the research evidence is inconsistent. Therefore, it has been recommended that the significance of age in relation to adherence be contextually determined.[5] Level of education is yet another factor that could effect adherence, as lower levels of education have been related to lower adherence.[54] However, interventions aimed at improving patients´ knowledge of their medication treatment do not always result in the expected outcome.[53] As regards

differences between men and women in relation to adherence, it has been reported that there is no evident difference in adult samples.[55]

Therapy-related factors, for instance complexity of treatment regimen[5] or concerns about side effects,[56-58] could have a negative impact on adherence. Despite efforts on the part of pharmaceutical companies to develop medication treatments intended to facilitate adherence, such as medications with fewer side effects or combination therapies, it has been claimed that these efforts do not appear to be reflected in increased adherence figures.[53] A review on the topic reported that a reduction in daily doses was more likely to increase adherence to some medication treatments, but was not effective as a general measure.[59]

Patient-related factors are those related to individual resources, motives, attitudes or beliefs,[5] which can give rise to two sorts of non-adherence behaviour: intentional non-adherence and unintentional non-adherence.[41] The intentional variant is grounded in a conscious decision to deviate from the medication treatment.[41, 60] Beliefs about medication are most likely to play a significant role for this type of adherence behaviour. People who express beliefs that the prescribed medication is necessary for their health are less inclined to deviate from the prescription, while those who are concerned about side effects or becoming dependent are more likely to display intentional non-adherence.[61-64] Perceptions of illness could also influence adherence to medication treatment. For instance, people who do not perceive their asthma to be a chronic condition seem more inclined to refrain from the medication treatment.[65] Unintentional non-adherence refers to a willingness to adhere to agreed treatment, but this inclination fails due to factors such as forgetfulness or incorrect inhaler technique.[41, 60] Well-integrated routines for medication intake seem to be a necessity if this type of non-adherence behaviour is to be avoided.[66, 67]

One condition-related factor to consider in relation to adherence behaviour is self-perceived disease severity.[68, 69] People who perceive their condition as severe seem more inclined to be adherent.[68] It has also been reported that people who categorize their asthma as being of high severity seem more inclined to overuse their medication.[69] Comorbidity is another factor to consider. Depression[54, 58, 70, 71] and the cognitive impairments that

sometimes accompany this condition could lead to difficulties in remembering or adhering to treatment recommendations.[54]

The final dimension refers to the responsibility of the health-care team and system-related factors,[5] such as the interaction between the health-care professional and the patient, which is regarded as important for adherence.[54] Adherence is a multi-faceted behaviour, which requires sufficient resources in terms of health-care staff having the time and ability to promote this behaviour.[72] It also requires that health-care professionals have sufficient knowledge of adherence and effective interventions.[5] Interventions that both increase adherence and improve treatment outcomes have been described as complex in that they incorporate an array of strategies, but they still do not seem to result in large improvements.[73] Some examples of strategies – which, based on empirical evidence, are said to improve adherence either as stand-alone strategies or in combination with more complex interventions – are increasing adherence skills (such as training in how to integrate routines, using medication organizers), assessing readiness to initiate treatment, and increasing treatment-related knowledge, support and motivation. It is stressed that there is no single intervention that fits everyone.[40]

Adherence behaviour from a philosophical perspective

Four ethical principles are prominent in health care: the autonomy principle, the beneficence principle, the non-maleficence principle and the justice principle. The autonomy principle refers to a moral obligation to safeguard the values and beliefs of the patient, which stipulates that the best interest from a patient point of view is the primary moral consideration, as long as it does not adversely affect other considerations. The beneficence principle refers to a moral obligation, which is aimed at producing benefit for those being served. The non-maleficence principle refers to the moral obligation to avoid harm, which when applied to health-care professionals means providing the best balance of good over harm for the patient.[74] From a medical perspective, it means preserving health and preventing disease and injury, which in the context of adherence advocates moral support for deliberate interventions to improve adherence to treatment.[72] As stated above, interventions to enhance adherence could be resource-consuming.[73] However, health-care professionals have a moral duty to be attentive to patients´ adherence behaviour, which could be described as a prima facie duty as it recedes into the background when

other duties have higher priority. Consequently, these ethical principles could come into conflict with each other, and in such situations health-care professionals are obliged to comply with the patient's preferences without jeopardizing their professional knowledge. The prescriber has a moral duty to ascertain that the patient is making an informed choice and is aware of the consequences. The prescriber's duty is to promote what is good for the patient from a medical perspective, which implies that the prescriber is obliged to recommend initiation of the treatment. The transition from compliance to adherence reflects the importance of patient autonomy, but an extension of the concept that more clearly incorporates the patient's informed choice would be welcomed.[72]

From a philosophical perspective, we could ask whether patients have a moral duty to adhere to a prescribed medication. Patients have autonomy as regards accepting or declining a treatment. Therefore, a patient´s choice to decline a treatment is not to be labelled non-adherence, even though it could be viewed as such from a medical perspective. This is an important distinction when defining adherence. It has been argued that not adhering is a failure on the part of the patient to live up to his/her ethical duty.[75] According to Kant,[76] two types of duties exist: the perfect and the imperfect. A perfect duty is predominant and ought to be followed. An imperfect duty, on the other hand, allows a certain scope of action owing to people's sometimes limited abilities to fulfil a duty.[76] People have a moral imperfect duty to take care of their health and to adhere to a medication treatment if they accepted it. People also have a moral duty not to lie, which implies that both the patient and the prescriber have a moral duty to be honest with each other.[75] Resnik[75] explained that with an 'ought' follows a 'can' and *"one cannot have a moral duty to do something that one cannot do"* (p. 175).[75] Thus, patients can have rational reasons for not adhering to a previously accepted treatment, for instance if they cannot afford the medication or feel worse because of its side effects. Nevertheless, it could be argued that the patient has a duty to inform the prescriber.

Adherence in relation to personality traits

Some previous studies have recognized associations between the FFM personality traits and adherence behaviour. Neuroticism has been associated with lower medication adherence among patients with multiple sclerosis[77] and patients with asthma.[78] Extraversion has been positively related to adherence to exercise among cancer survivors,[79] but negatively

associated with adherence to antidepressant medication treatment.[80] Agreeableness has been identified as a positive correlate of adherence behaviour in candidates for liver transplantation.[81] The personality trait that seems to be most frequently associated with adherence behaviour is Conscientiousness, which has been identified as a positive influential factor for medication adherence in patients undergoing renal dialysis,[3] patients with HIV[82] and patients who have been prescribed cholesterol-lowering medications.[83] Conversely, Penedo et al.,[84] who studied the FFM personality traits in relation to medication adherence among patients with HIV/AIDS, failed to show any clear associations.

Measuring adherence

There is no available gold standard for assessing adherence at present.[5] It is difficult to attain a reliable set of adherence measurements, and a mixture of methods is probably preferable. There are several different methods to choose among, and these can be divided into indirect methods and direct methods.[85]

Indirect methods

One common indirect method is the so-called self-report, which usually is conducted using questionnaires or interviews about medication use.[85] One drawback of this method is recall bias[40] and social desirability bias,[85, 86] which could result in overestimation of adherence.[86] The method has the advantage of being cost-effective, and reports of low adherence could be regarded as reliable.[86] The method of self-reported adherence has been evaluated in comparison to more objective measures. One study found that self-reported adherence correlated with adherence measured electronically. When the adherence scores were dichotomized, high self-reported adherence predicted high electronic adherence.[87] In contrast, another study demonstrated that canister weight and electronic monitoring were more reliable than self-report and pharmacy records.[88] A meta-analysis concluded that self-reported adherence gives a good estimation of adherence to medication treatment.[89] Electronic monitoring is conducted using an electronic device that contains a microprocessor that registers the time and date when the pill-box is opened or the inhaler is used.[90] The term medication measurement means that the pills are counted or the inhalers weighed, and what is left is then compared to the prescription. One weakness of this method is that it only provides information about the

content of the pill-box, but no information about actual medication intake. Refill adherence is yet another indirect measure. The idea is that adherence is assessed using data on prescriptions, dispensed medication and refills from the pharmacy databases. One weakness, though, is that it is impossible to know whether the medication has actually been taken.[85]

Direct methods

One example of a direct method is biochemical analysis of body liquids in order to detect levels of medication, byproducts or markers. This is claimed to be the only accurate method of measuring adherence, because it gives a direct indication of whether or not the medication has been taken.[85] On the other hand, it has been argued that it only provides information on recent medication intake, but does not provide information on long-term adherence behaviour.[90] Another example is directly observed therapy. When this method is used, observations of each dose must be made, which could be in conflict with integrity policies.[85]

Asthma control

The ambition of modern asthma treatment is to achieve and preserve clinical control, which the Global Initiative for Asthma (GINA, p. 22)[91] defines as:

- No (twice or less/week) daytime symptoms
- No limitations in daily activities including exercise
- No nocturnal symptoms or awakening due to asthma
- No (twice or less/week) need for reliever medication
- Normal lung function results.

Well-controlled asthma is thought to be an attainable goal for most people with asthma, thanks to today's asthma medication treatment.[91] A published study, conducted in Sweden, reported that these goals are not reached and that no improvement in asthma control has occurred between 2001 and 2005.[92] Studies performed in other countries have also reported figures showing suboptimal asthma control.[93-95] Several factors are recognized for their association with low asthma control, such as female sex,[92, 93, 95, 96] current smoking,[92, 93, 97] high body mass index (BMI),[93, 98] high dose of inhaled corticosteroids and perceived hyper-responsiveness to increasing

numbers of triggers.[97] There are indications that discrepancies exist between reported asthma symptoms and perceived asthma control,[94, 95, 99] whereas Katz et al.[100] showed that greater perceived asthma control was linked to less severe asthma. Research shows that good asthma control influences health-related quality of life (HRQL) positively.[96, 100, 101] To the best of our knowledge, the relationship between the above-described personality traits and reported asthma control has not yet been explored.

Health-related quality of life

The prevalence of chronic disease is constantly increasing and related treatments need to be evaluated on a personal level. In that respect, estimations of HRQL serve as a crucial health outcome, as they capture personal perspectives and experiences of everyday life with a chronic disease and/or ongoing treatment.[102]

HRQL in relation to adherence behaviour

Literature describing the relationship between adherence and HRQL appears to be rather scarce. One published study[103] failed to show any associations between the variables in question; a second study found weak associations or what it described as *"negligible associations"*.[104] A third study identified associations between two items in an HRQL measure and adherence. Participants scoring high on vitality reported lower adherence scores, and those reporting less bodily pain were more likely to adhere to the prescribed medication treatment.[105]

HRQL in relation to personality traits

Self-reports on HRQL may also be influenced by people's scores on personality traits, which has been shown in a small number of studies on samples with different health conditions.[106-109] According to these studies, Neuroticism seems to be negatively related to HRQL,[106-109] whereas Extraversion seems to be both positively[106, 108, 109] and negatively[109] related to HRQL. Openness to experience has been negatively associated with low HRQL as regards social function[107], mental well-being[106] and physical function.[107] Higher scores on Agreeableness have been associated with better HRQL in regard to physical health.[106] As regards Conscientiousness,

higher scores were related to better HRQL in one study,[107] but another study could not show any associations.[106]

Self-efficacy

According to Bandura,[110] social cognitive theory stipulates that striving for control in life is fundamental in human beings. This striving is said to permeate most of our actions. A person's action is the result of what is called triadic reciprocal causation, which refers to the interaction between behaviour, internal factors such as cognitive, affective and biological factors and the environment. This means that human beings are active in selecting and shaping their environment, but that their beliefs in their ability to do so, their self-efficacy, have an impact on their achievements. Self-efficacy can be defined as a person's confidence in his/her ability to handle challenges and stressors in everyday life, and it is therefore likely to influence that person's thoughts, motives, feelings and behaviour. People with high perceived self-efficacy are inclined to adhere to healthy behaviours. Self-efficacy can be strengthened through deliberate interventions to improve an outcome,[110] which in fact has been demonstrated in relation to various chronic diseases.[111-113]

Self-efficacy in relation to adherence

The relationship between self-efficacy and adherence to medication treatments in various chronic diseases has previously been described. For instance, disease-specific self-efficacy has been reported to be positively associated with adherence behaviour in patients with asthma,[114] hypertension,[115] rheumatoid arthritis,[116] HIV[117] and coronary heart disease.[118] In a study among patients with prescribed diabetes treatment, low self-efficacy was associated with lower adherence.[56]

Self-efficacy in relation to personality traits

There are very few studies exploring personality traits in terms of the FFM and self-efficacy in concert. In a study performed by Williams et al.,[119] Neuroticism predicted poor self-efficacy, while Extraversion had a positive impact on self-efficacy. Franks et al.[120] found that study participants with various chronic diseases who reported high scores on Neuroticism and/or low scores on Conscientiousness, Agreeableness and Extraversion

managed to increased their self-efficacy after having participated in a customized intervention. This intervention aimed at strengthening self-efficacy through several self-management tasks of importance when living with a chronic disease.

Rationale

The significance of personality traits in relation to adherence behaviour, asthma control, HRQL and self-efficacy is not completely unexplored, but it does not seem possible to draw any conclusions as yet, which inspires further research in this field. Despite the large body of adherence research in recent decades, adherence to medication treatment seems to remain suboptimal. Asthma control, which is the goal of today's asthma treatment, is apparently not being achieved, despite the available medication treatment. Reports of experienced asthma control and HRQL may be shaped by the influence of different personality traits, but research on this aspect is limited. Looking at personality in relation to the other described variables in concert could result in a deeper understanding of specific personal resources and needs, which could be beneficial when planning interventions for use in clinical practice.

Aims of the thesis

The overall aim

of this research project was to explore the significance of personality traits in relation to adherence to medication treatment and asthma control, health-related quality of life and self-efficacy.

The specific aims were:

I. first to determine whether personality traits in young adult asthmatics are related to asthma control and HRQL, and second to examine the influences of personality traits on adherence to regular asthma medication treatment.

II. to determine whether a relationship exists between FFM personality traits and reported adherence to medication in a random population of adults aged 30-70.

III. to elucidate adherence reasoning in relation to asthma medication.

IV. to explore the function of self-efficacy and adherence as mediators for the influencing effect of personality traits on health-related quality of life in persons with chronic disease.

Method

Participants

Study I and Study III

This sample consisted of young adults with asthma born between 1984 and 1986. They were selected from a previous epidemiological study.[121] In Study I, participants were invited to take part through mailed informational letters including questionnaires. The response rate was 73.3%. In Study III, 18 participants were invited through telephone calls combined with mailed informational letters.

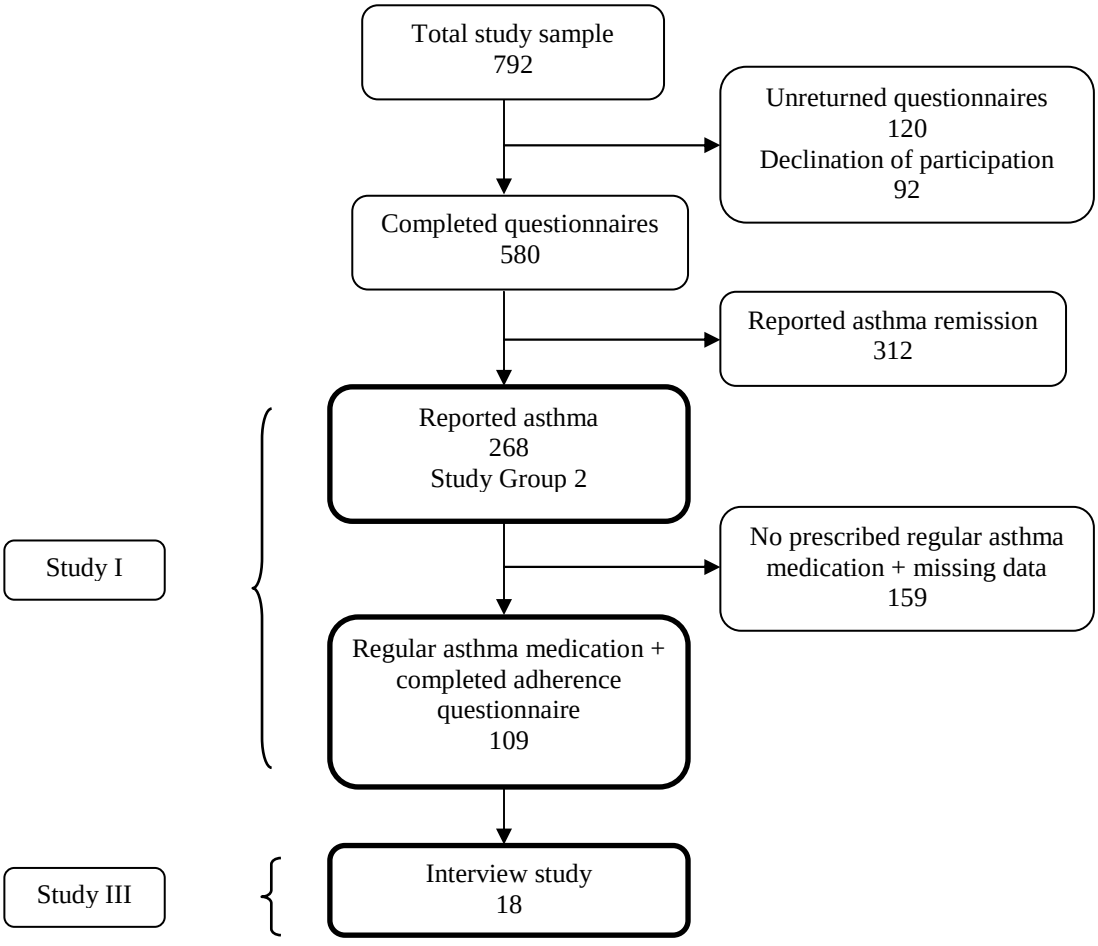

Figure 1. Sampling procedure in Study I and III.

Study II and Study IV

This sample consisted of participants born in 1939-1979 selected at random in two municipalities in western Sweden. Contact information for eligible participants was provided by the Swedish population register. The participants were invited through an informational letter together with questionnaires sent by mail. Two reminders were sent to non-responders. Finally, 2001 questionnaires were returned, giving a response rate of 40.0%. A non-response study based on a random sample was conducted by telephone. The participants answered eight standardized questions from the origin questionnaires including five items from the personality questionnaire.

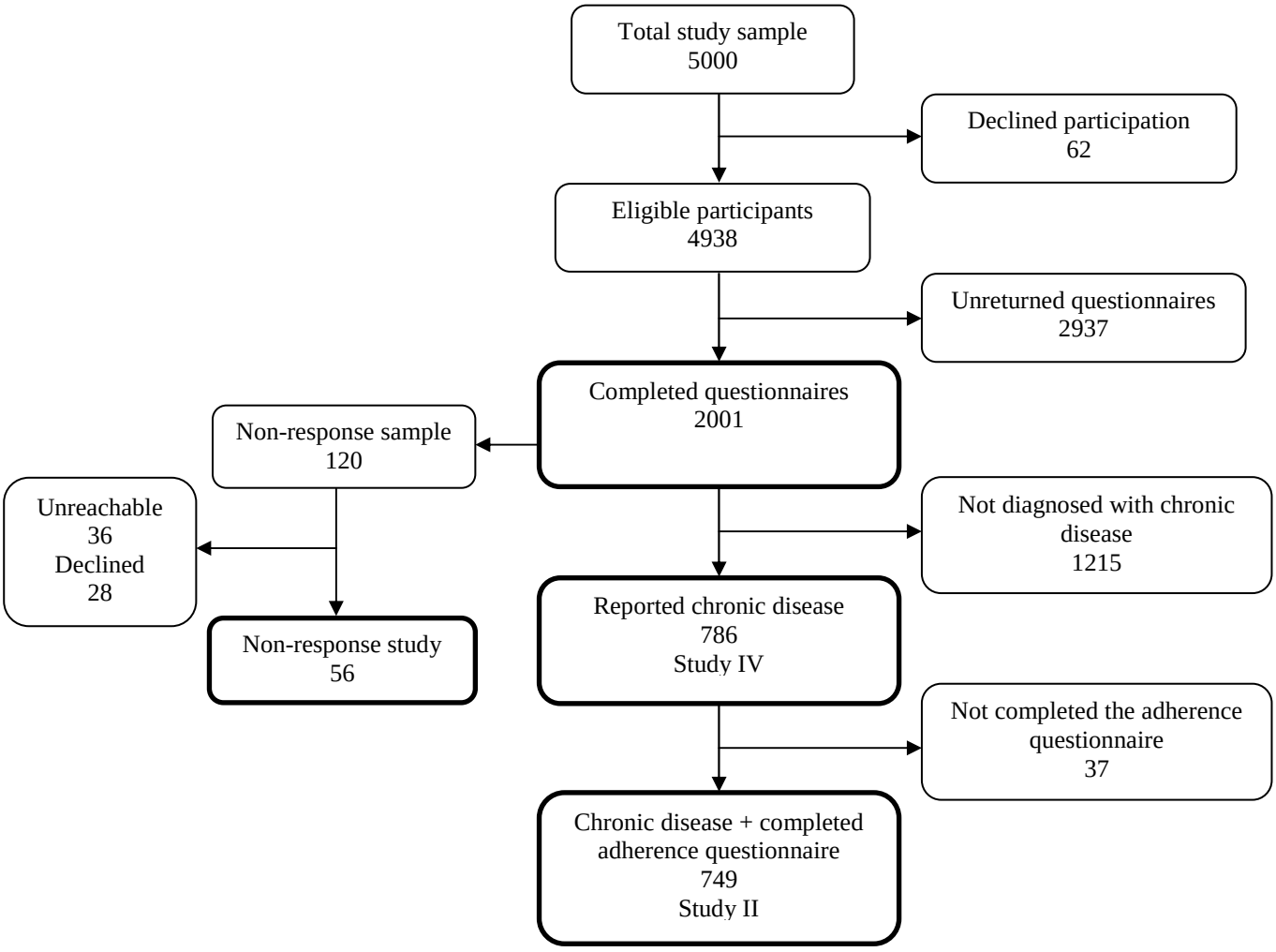

Figure 2. Sampling procedure in Study II and IV.

Data collection

Questionnaires

The questionnaires described below were used to collect data on personality, adherence and asthma control, HRQL and self-efficacy. The questionnaires were all constructed so that the participant was required to decide to what extent each statement was relevant to him/her.

The Health-relevant Personality 5 factor inventory (Study I)

The Health-relevant Personality 5 factor inventory (HP5i) was used to measure five health-relevant facets of the FFM personality traits: *Negative Affectivity* (as a facet of Neuroticism), *Hedonic Capacity* (as a facet of Extraversion), *Alexithymia* (as a facet of Openness to experience), *Antagonism* (as a facet of Agreeableness) and *Impulsivity* (as facet of Conscientiousness). This inventory contains 20 items, four for each health-relevant facet, ranging from "does not apply at all" to "applies completely" scored 1-4, from which a mean value is calculated. The HP5i was constructed to meet the need for a very short personality inventory for use in large-scale or cohort studies.[122] It should be clarified that *Alexithymia*, *Antagonism* and *Impulsivity* represent health-relevant facets at the opposite ends of the personality traits Openness to experience, Agreeableness and Conscientiousness. The Cronbach´s alpha values for the HP5i ranged between 0.62 and 0.72 for Study I.

The Neuroticism, Extraversion and Openness to experience Five-Factor Inventory (Study II and IV)

A Swedish version of the widely used Neuroticism, Extraversion and Openness to experience Five-Factor Inventory (NEO-FFI), which assesses the five personality traits according to FFM, was used. The NEO-FFI contains 60 items, 12 per personality trait,[6] with response alternatives ranging from "strongly disagree" to strongly agree", scored 0-4. The Cronbach's alphas values for the NEO-FFI ranged between 0.69-0.87 for Study II and IV.

The Medication Adherence Report Scale (Study I, II and IV)

Adherence behaviour was measured through self-report on the Medication Adherence Report Scale (MARS). The MARS contains five statements, representing different adherence behaviours, each with five response alternatives ranging from "always" to "never", scored 1-5 with a total score of 25. The higher the score, the better the adherence.[65] The MARS has previously been used in samples with chronic disease and has shown good internal reliability.[123-125] After having received permission from the originator of the MARS, the questionnaire was translated from English to Swedish by two native Swedish-speaking nurses. Thereafter the MARS was back translated to English by a professional translator who is a native speaker of English. This version was sent for approval to the originator before permission to use the questionnaire was received. The Cronbach's alpha values for the MARS ranged between 0.71 and 0.81 for Study I, Study II and Study IV, respectively.

The Asthma Control Test (Study I)

The Asthma Control Test (ACT) is a five-item scale for estimation of asthma control. Each item was scaled from 1-5, and by summing the response values a scale score was calculated ranging from poor (5) to total (25) control. A cut-off point of $\leq$19 indicates poorly controlled asthma, and scores of 20 points or more correspond to well-controlled asthma.[126] The ACT was developed by Nathan et al.[127] and further evaluated in a longitudinal study by Schatz et al.[128] The Cronbach´s alpha value was 0.75 for Study I.

The Short Form-8 Health Survey (Study I and IV)

A Swedish version of the Short Form-8 Health Survey (SF-8) was used to evaluate HRQL in relation to both physical and mental well-being. The SF-8, which is constructed from the widely used SF-36, was developed for use in larger samples. The SF-8 contains eight items that measure physical and mental HRQL on a five- or six-graded scale, which is transformed to a scale of 0-100. The physical dimension, which could be collapsed into a physical component score (PCS), consists of: physical functioning, role limitations due to physical problems, bodily pain and general health. The mental dimension, which could be collapsed into a mental component score (MCS), consists of: vitality, social functioning, role limitations due to emotional problems, and mental health.[129] The component scores PCS and

MCS were used in the present studies. The Cronbach´s alpha values for PCS were 0.83 and 0.86 and for MCS 0.82 and 0.85 for Study I and Study IV, respectively.

The Perceived General Self-efficacy Scale (Study IV)

The General Self-Efficacy Scale (GSE) measures people's self-belief in their ability to handle difficult demands in everyday life. GSE consists of 10 items, each with four response alternatives ranging from "not at all true" to "exactly true", scored from 1-4.[130] The GSE has been translated and tested across cultures, with Cronbach's alpha values ranging between 0.75 and 0.91,[131] which could be compared to the Cronbach's alpha value for Study IV, which was 0.84. The GSE has been used in samples with various chronic diseases[132] and has also been studied in relation to the FFM personality traits.[133]

Interviews

In Study III, the data were collected through interviews and according to Grounded Theory (GT) methodology.[134] The initial interviews were performed in a rather unprejudiced fashion starting with an open-ended question about medication intake that was followed by probing questions. This approach was used to avoid steering the interviews in a given direction. Gradually, the interviews became more systematic so as to enable comparisons with the ideas emerging from the analysis. The interviewer still strived for a flexible stance to permit new events and directions in the interviews. Directly after an interview, a memo was written to document the interviewer's instant impression of the collected data. The interviews lasted on average 45 minutes; they were recorded digitally and transcribed verbatim.

Analyses

Study I

The Statistical Package for the Social Sciences (SPSS) 15.0 was used to calculate descriptive statistics (frequencies, means and standard deviations) and *t*-tests for comparisons of means between groups. Pearson's correlation coefficient (*r*) was used for correlations between interval variables and

Spearman's *r* for correlations including an ordinal variable. Multiple regression analyses were performed to make predictions concerning the mental and physical component of HRQL. The variables physical activity and smoking were transformed into dichotomous variables (0 = no, 1 = yes) in the regression analyses.[135] Multiple regression with spline function[136] was used to make estimations of associations between the HP5i and the MARS.

Study II

In the main study (n=749), descriptive statistics, including frequencies, percentages, means and standard deviations, were calculated for all scores. Differences in socio-demographic variables, personality and adherence scores between men and women were analysed with Fisher's permutation test. Univariate associations between personality traits and adherence behaviour were tested using Pitman's permutation test.[137] Non-linear relationships between the dependent variable in the MARS and the independent predictors (personality traits) were estimated by multiple regression with a spline function.[138] Means of personality traits, adherence scores and age were compared using Student's *t*-test. In the non-response study, non-responders were compared with the original sample (n=2001) by using the Chi-square test, Mann-Whitney test, and Student's *t*-test.[139]

Study III

The sampling procedure and analysis of the interview data were performed in accordance with GT methodology.[134] The computer-based program NVivo was used to handle and organize the data.[140] The analysis was carried out through a constant comparison of data, with a focus on similarities and differences among ongoing processes. This part of the analysis resulted in codes, which were organized into preliminary categories and named with respect to meaning of content. The preliminary categories were tested as regards dimensions and properties during the following interviews. The subsequent focused coding identified variation in adherence motives, which needed a proper explanation. At this point, appropriate literature was consulted to stimulate creative thinking,[134] which led us to Higgins's theory of self-regulatory focus as a motivational principle.[141] The theory – including the two systems prevention and promotion foci – was regarded as containing the overlooked and missing parts needed to develop the refined categories we called *"promotive focus"*

and *"preventive focus"*. The final category, *"permissive focus"*, could perhaps be seen as an extension of Higgins's theory[141] because it was based on data that did not fit into that theory. The subsequent axial coding resulted in the creation of subcategories related to the three categories. As *"illness control"* seemed to be fundamental to adherence behaviour, the theoretical sampling was concentrated on discovering aspects of this concept, which resulted in the emergence of the core category: *"A functional asthma day as desired by the person"*.

Study IV

Besides descriptive statistics, Pearson's correlation coefficient was calculated using SPSS version 17. Two path models for each personality trait were constructed, in which the correlation between two variables was calculated as the sum of the compound paths connecting these two points. A correlation between two variables is termed indirect or mediated if it is dependent on the presence of an additional variable. The analyses were performed using the statistical modelling program Mplus version 5[142] together with STREAMS,[143] which is a structural equation modelling environment. The personality traits were regarded as independent variables, GSE and MARS as mediators and PCS and MCS as dependent variables.

Ethical considerations

Approval was granted by the Regional Ethical Review Board at the University of Gothenburg (dnr: 486-06, dnr: 560-08). Ethical principles based on the Helsinki declaration were followed. All participants received written information about the aim and utility of the studies. In the interview study and in the non-response study, the participants also received the same information verbally. All participants in the interview study gave their written informed consent. The participants were informed that all information they gave would be handled confidentially and that no information would be traceable to a single individual. The participants were also informed that they could withdraw from the study at any time without stating a reason.

Findings

Study I

Findings in Study Group 1 (n=268)

The sample consisted of 165 (61.6%) women and 103 (38.4%) men aged 22 (+/-1 year). In general, the participants reported that their asthma was in control (mean 21.34, SD 3.73), with no difference between women and men. As illustrated in Table 2, two of the five personality traits were associated with asthma control. Participants scoring high on Negative Affectivity or Impulsivity were associated with reports on lower asthma control. Moreover, both the physical and the mental dimension of HRQL were positively associated with asthma control. In addition, both Negative Affectivity (r=.125, p<0.05) and Impulsivity (r=.213, p<0.001) were positively associated with smoking.

Table 2. Correlates of asthma control.

Variable	ACT	p-values
Negative Affectivity	-.287	0.001
Hedonic Capacity	.079	n.s
Antagonism	-.092	n.s
Alexithymia	-.007	n.s
Impulsivity	-.152	0.05
MCS	.288	0.001
PCS	.465	0.001

ACT= Asthma Control Test
MCS=Mental Component Score
PCS=Physical Component Score
n.s=non-significant

A multiple regression model (F =27.820, p<0.001) explaining 43% of the variance in MCS (Adjusted R^2 = 0.426) identified Negative Affectivity, Impulsivity and smoking habits as negative predictors of the mental

dimension of HRQL. Alexithymia, Hedonic Capacity and asthma control were identified as positive predictors of the mental dimension of HRQL. In a model (F=20.333, p<0.001) explaining 24% of the variance in PCS (Adjusted R^2 = 0.236), asthma control and physical activity were identified as positive predictors of the physical dimension of HRQL.

Findings in Study Group 2 (n=109)

Study Group 2 consisted of 73 (67%) women and 36 (33%) men aged 22 (+/-1 year). The reported mean score for adherence was 19.04 (SD, 3.89), which could be compared with the maximum score of 25. There was no difference in reported adherence scores between women and men. Instead, participants prescribed an inhaler combining corticosteroids (ICS) and long-acting β_2-agonists (LABA) reported higher adherence scores (mean 20.4, SD 3.6) than participants who were prescribed inhalers with separate medication treatment (mean 18.1, SD 3.9), (p<0.05). As regards personality and adherence, participants high in Impulsivity were associated with lower adherence scores (r=-.187, p<0.05). In male participants, negative associations were found between adherence and Alexithymia (r=-.369, p<0.05) and Antagonism (r=-.368, p<0.05). No associations between personality traits and adherence were found in women.

The non-linear associations (Figures a-e in enclosed Paper I) between personality traits and MARS scores estimated by the multiple regressions with spline function showed that lower scores on Negative Affectivity were associated with increases in MARS scores. A clear non-linear association between both Hedonic Capacity and Alexithymia in relation to MARS was seen, which showed that lower scores on these traits were positively associated with MARS scores while higher scores were negatively associated with MARS scores. Moreover, indicated negative associations between both Antagonism and Impulsivity in relation to MARS scores were seen.

Study II

The study sample consisted of 427 (57%) women and 322 (43%) men with a mean age of 53.59 (SD 11.09). They all reported having been diagnosed with a chronic disease, and the most commonly reported diseases were hypertension (31%), allergic rhinitis (16.4%), depression (13.6%), asthma

(11.5%) and diabetes (9.9%). The reported mean score for adherence was 22.73 (2.94). No difference in adherence scores between men and women was found. As illustrated in Table 3, three of the personality traits and age were associated with adherence.

Table 3. Correlations between adherence scores (MARS) and personality traits and age.

Variable	MARS*	p-values
Neuroticism	-0.155	0.001
Extraversion	0.012	0.30
Openness to experience	-0.064	0.082
Agreeableness	0.129	0.001
Conscientiousness	0.162	0.001
Age	0.238	0.001

* MARS=Medication Adherence Report Scale

A multiple regression analysis with a spline function (Figures a-e in enclosed Paper II) showed a negative relationship between Neuroticism and MARS across the entire scale. Both associations between Conscientiousness and Agreeableness and MARS were clearly non-linear. Initial scores on both these personality traits were associated with increasing MARS scores while higher scores were associated with decreasing MARS scores. Further analysis of these findings indicated that participants rated high on Conscientiousness but lower on MARS scored significantly higher on Neuroticism or reported lower age than those scoring high on MARS, as well as that participants rated higher on Agreeableness but lower on MARS simultaneously scored lower on Conscientiousness or higher on Openness to experience compared to those scoring high on MARS. These findings suggest that high scores on Conscientiousness and Agreeableness could be associated with both lower and higher MARS scores and that personality traits are interacting in their effects on adherence behaviour. Spline functions exploring estimated relationships between Openness to experience and MARS revealed that lower scores on Openness to experience were associated with slight increases in MARS scores, while higher scores were associated with a slight reduction in MARS scores. Extraversion could not be regarded as an influential factor in relation to adherence behaviour in the present study.

Data from the non-response study were compared to the whole study sample (n=2001). The comparisons showed that study participants reported chronic disease to a greater extent than did non-responders, but that there were no differences as regards age and education level. Non-responders scored higher on Neuroticism, Extraversion and Agreeableness compared to participants.

Study III

The analysis based on data from interviews with 18 young adults with asthma emerged in a theoretical model (Figure 1 in Paper III), which illustrated that adherence to asthma medication was motivated by three foci, promotive, preventive and permissive, which regulated different types of medication tactics, all directed towards a desired outcome: *"a functional asthma day as desired by the person"*. A *promotive focus* was associated with the ambition to achieve a positive asthma outcome and regulated the medication tactic *approaching illness control*, which entailed being adherent either to the received prescription or to a self-adjusted dosage. A *preventive focus* was intended to ensure avoidance of a negative asthma outcome and regulated the medication tactic *avoiding uncontrolled illness*, either by sticking to the prescription or by preventively overusing the medication. A *permissive focus* was aligned with a kind of "let-it-go" mentality, according to which everything will turn out fine and regulated the medication tactic *acting on the spur of symptoms*, in which medication intake was unstructured and primarily triggered by asthma symptoms.

Study IV

The participants consisted of 448 (57%) women and 338 (43%) men with a mean age of 53.7 (SD 11.1) and with various chronic diseases. The findings showed that both general self-efficacy and adherence functioned as mediators for the influencing effect of four of the five measured personality traits. Self-efficacy mediated the effect of Extraversion (.232, T=5.789) and Conscientiousness (.288, T=6.900) on the mental dimension of HRQL. Openness to experience had an indirect effect on both the physical (.141, T=3.687) and the mental (.379, T=10.608) dimension of HRQL through self-efficacy. Adherence functioned as a mediator between both Agreeableness (.112, T=2.775) and Conscientiousness (.090, T=3.337) on the mental dimension of HRQL. As regards Neuroticism, this personality trait had a direct effect on both the physical and the mental

dimension of HRQL, but no indirect effect through self-efficacy or adherence.

Overview of the findings

Personality traits for which there may be an increased need for assistance with adherence behaviour

High Impulsivity	High Alexithymia in men	High Antagonism in men
High Neuroticism	Low Agreeableness	Low Conscientiousness
High Agreeableness with concurrent low scores on Conscientiousness or high scores on Openness to experience		High Conscientiousness with concurrent high scores on Neuroticism

Personality traits for which there may be an increased need for assistance with asthma control

High Negative Affectivity	High Impulsivity

Personality traits for which assistance with strengthening self-efficacy may improve mental well-being

Low Extraversion	Low Openness to experience	Low Conscientiousness

Personality traits for which assistance with increasing medication adherence may improve mental well-being

Low Agreeableness	Low Conscientiousness

Medication tactics for which there may be an increased need for assistance with adherence behaviour

Promotive medication adjustment	Preventive medication overuse	Permissive adherence reasoning	Unstructured medication use

Discussion

Personality traits, adherence, asthma control, HRQL and self-efficacy

The present thesis has shown that the personality trait Neuroticism seems to play a significant role in relation to adherence behaviour and HRQL in people with chronic disease. High scorers on Neuroticism seem to be more inclined to deviate from treatment recommendations such as adhering to an initiated regular medication treatment – a finding that has been supported by previous research.[77, 78] Furthermore, participants with asthma who scored high on Negative Affectivity were more likely to be smokers, which is in glaring contrast to treatment recommendations for people with asthma.[91] The fact that smoking, in turn, seemed to have a negative impact on perceived mental HRQL, at least among the young adults with asthma, puts additional emphasis on the importance of identifying patients in clinical practice who may have some kind of emotional instability, owing to the possible increased need for support with disease management among these patients.

People scoring high on Neuroticism have been described as being more frequent symptom reporters than are more emotionally stable people.[17, 18] This is in line with the reports from participants scoring high on Negative Affectivity and Neuroticism in the current studies, who seemed to experience both poor asthma control and poor HRQL. This behaviour per se need not be negative, because it could lead to early contact with health care. In an attempt to identify a possible strategy to support those with higher scores on Neuroticism, Study IV sought to show that improving adherence and bolstering self-efficacy could be useful in increasing their HRQL. This was not successful in relation to Neuroticism. Instead, it was obvious that Neuroticism has a greater direct impact on experienced HRQL, which indicates that other strategies are needed. As a suggestion, a more effective method could be to provide support using strategies to tackle emotional expressions. This highlights the need for further studies to identify possible useful methods to support the *"worrying kind of person"*.

Based on the studies in the current thesis, Extraversion does not seem to have an impact on adherence behaviour in relation to medication treatment in chronic disease. To our knowledge, two former studies have presented associations between Extraversion and adherence. The first was in relation to treatment with antidepressants,[80] which indicates that we cannot rule out that specific personality traits may have a specific meaning in different chronic diseases. The second study found an association in relation to exercise adherence,[79] which is most likely explained by the fact that people who are highly influenced by Extraversion take pleasure in a physically active lifestyle.[21] In fact, Extraversion was positively associated with physical HRQL, which was shown in its direct effect on this dimension of HRQL. People less influenced by this personality trait could be described as slightly reserved and socially withdrawn.[6] As Extraversion also had an indirect effect on mental HRQL via self-efficacy, strengthening self-efficacy in low scorers on this trait could be a useful method of improving their mental well-being.

Openness to experience was not associated with medication adherence in the present studies. However, young adult men with asthma, who rated themselves high on the health-relevant facet Alexithymia, also reported lower adherence scores. This finding is in line with a previously published pilot study among patients with asthma, which also found a negative relationship between adherence and Alexithymia.[144] However, this study is inconsistent with the present thesis as regards the findings on HRQL and asthma control, and this inconsistency may be explained by differences in sample characteristics and/or assessments of Alexithymia. Further studies are needed in this area.

Moreover, people less influenced by Openness to experience tend to have lower self-efficacy, but with reference to the current thesis they could improve both their mental and physical HRQL if they managed to strengthen their self-efficacy. This underlines the importance of identifying these patients in clinical practice. People less influenced by this personality trait could be characterized as rather conventional with a preference for what is old and proven,[6] indicating that it could be a challenge for health-care professionals to find a suitable intervention. Nevertheless, based on the current results, finding such an intervention may be well worth the effort. This potential intervention may have to be viewed in the light of earlier reports showing that people with higher scores on Openness to experience have been associated with risk-taking behaviour[13] and less

healthy behaviour,[14] which could be explained by their increased tendency to seek new experiences.[6] The present thesis showed that higher scores on Openness to experience were related to higher self-perceived self-efficacy, which involves having a greater belief in one's ability to handle challenges in life.[110] We suggest that these relationships be taken into consideration when planning interventions to reinforce self-efficacy.

Another personality characteristic that should be identified in relation to disease management is low levels of Agreeableness, as people with low scores on this trait seem to be predisposed to lower adherence to medication treatment. The health-relevant facet Antagonism was also identified as a negative correlate of adherence to asthma medication in men. Participants in the present studies who were less influenced by Agreeableness also tended to have a propensity for experiencing low HRQL. The mental dimension of HRQL might be possible to increase through improvements in adherence to medication, because adherence mediated the effect of Agreeableness on the mental dimension of HRQL. People with low levels of this personality trait may be described as antagonistic and sceptical about other people's intentions,[6] which indicates that building mutual trust between the patient and the health-care professional may be the first priority for a successful outcome.

A person greatly influenced by Conscientiousness could be described as a person with "character", who is predisposed to being orderly, dutiful, achievement-oriented and self-disciplined.[6] Thus, the conscientious person was associated with appropriate disease management in terms of high adherence to prescribed medication and with both high HRQL and high self-efficacy. In contrast, we suggest that it is essential to recognize people at the lower end of this personality trait, because they seem to require assistance with their disease management. They reported lower adherence and they were also associated with both lower self-efficacy and lower HRQL. Impulsivity, as the opposite health-relevant facet of Conscientiousness, was associated with low adherence to asthma medication and with negative reports on asthma control, HRQL and smoking. People less influenced by Conscientiousness tend to be somewhat unstructured and aimless in disposition[6] and could be assumed to be in need of support to integrate routines or to require reminders for their medication intake, which could be initiated with guidance from health-care professionals. This is of particular interest, as our findings showed that an increase in adherence and self-efficacy may have had a favourable effect on

mental well-being among our less conscientious study participants. Furthermore, it has previously been reported that lower scores on Conscientiousness have been related to smoking[20] and in Study I the young adults with asthma, who scored high on Impulsivity were associated with smoking, which not coincides with proper asthma management[91] and therefore may be viewed as an unmet need of support.

Findings in relation to the adherence concept

Critical voices have been raised against the concepts of adherence and compliance because neither of them includes motivations for encouraging the patient to make a decision about his/her medication use – this in combination with the unfair categorization of adherers and non-adherers.[145] With reference to the findings of Study III, these voices may deserve acknowledgement, as the participants seemed to have been guided by three motivational foci, which inspired different medication tactics aimed at the goal of having a functional asthma day. All of the participants had adopted a conscious medication tactic suitable to achieving their goal with regard to intake of asthma medication. From their perspective, it would be groundless to label any of them as non-adherent, though such a label would be assigned from a medical point of view. To achieve a win-win adherence situation, health-care professionals engaged in care of patients with asthma or other chronic diseases should focus on empowering patients to make informed health choices,[146] which could be seen as a moral duty.[72] The patient's responsibility is to actively participate in his/her care and to strive for a better health outcome,[146] which he/she has a moral duty to do,[75] and this includes adherence to treatment.[146] To do this, the patient requires health literacy, and promoting this literacy is the responsibility of health-care professionals.

With further reference to Study III, it is obvious that interventions should not solely be aimed at improving adherence behaviour, but they should also be linked to an explicit desired outcome defined by the patient. This outcome could deviate from that defined by a medical perspective. As an example, the young adults said that their desired outcome was a functional asthma day, but for a clinician or asthma nurse, the outcome of proper adherence to asthma medication treatment could be focused on disease progress, which from a patient perspective might seem incomprehensible. For this reason, health-care professionals should concentrate on what medication tactic the patient is using to achieve a functional day, instead of

defining divergent tactics as non-adherence. This position could be viewed as a contribution to the debate on the concepts "adherence" and "compliance".

The etymological origin of the word tactic is the Greek word *taktikē (tekhnē)*, which means *"an action or strategy carefully planned to achieve a specific end"* (p. 1465).[37] Having a medication tactic could enable the patient, with support from health-care professionals, to use this tactic to achieve the desired outcome of a medication treatment. It takes a tactic to achieve a set goal. Not one of the concepts compliance, adherence or concordance seems to include such a path towards a set goal. Compliance and adherence tend to lead to a dichotomized labelling into: high/low, good/bad proper/improper, adequate/inadequate, satisfactory/unsatisfactory adherence, while concordance seems to strive towards an agreement between the patient and the prescriber in best-case scenarios. When different perspectives contrast in the context of health care, the patient's preferences are superordinate when considering the autonomy principle. Introduction of the term adherence in favour of compliance underlines the significance of patient autonomy. However, a further development of the concept is proposed, as the patient's informed choice is still not included.[72] Reflecting on the beneficence and non-maleficence principles, the prescriber has a duty to provide the best balance of good over harm for the patient.[74] Therefore, the term "medication tactic" could constitute a prudent alternative to the other concepts, as it considers both the patient and the prescriber perspective.

Methodological considerations

These four studies are unique in that they are based on an epidemiological design intended to explore personality and adherence behaviour. The strength of this design is that a random sampling procedure was applied, which minimizes the risk of sampling and selection biases.[147]

Study I was part of a previous epidemiological study, and we conducted a follow-up in the cohort of participants who in the initial study had reported an asthma diagnosis. In this study, the response rate was considered satisfactory. In Study II the study population was estimated to be large enough for statistical inference, but the low response rate constituted a risk in that respect.[147] Despite the low response rate, previously established

societal structures like sex differences in the incidence of chronic disease[148-153] and in Swedish wage statistics[154] were found, which was considered reassuring, as it increases the likelihood of representativeness.[135]

It has been argued that the number of responders in postal surveys has declined in recent years and that non-response analysis is seldom carried out.[155] This argument is applicable to Study II, which had a low response rate. On the other hand, a non-response study was conducted, which is a strength.[147] The non-response study did not reveal any differences as regards age or education level, but the non-responders did report a lower frequency of chronic disease than did participants in the original sample. This could explain non-participation, as a large proportion of the questionnaire items addressed aspects of chronic disease.

As hypothesized, there were differences in personality between non-responders and participants in the original study. Answering questions about disease and related aspects of health could trigger emotional distress in individuals rated higher on Neuroticism, and thus for these individuals, a reasonable choice would be to refrain from taking part. Higher scores on Extraversion indicate a preference for socializing with people,[6] which could discourage spending time on time-consuming questionnaires. Agreeableness was also rated higher among non-responders, which is inconsistent with the results of a study exploring the impact of personality traits on missing data.[156] Persons scoring high on Agreeableness are generally prone to please,[6] which in fact could explain the finding of the referred study on personality traits and missing data. These differences in findings could be based on the fact that the present study estimated personality using one item and not the entire scale. It is known that questions that are perceived as too sensitive and extensive questionnaires are both factors that negatively affect response rates.[157] The findings of the present non-response study were probably reinforced by the influence of the personality traits Neuroticism and Extraversion.

An additional strength was that all the participants in Study II and IV were above 30 years of age, when the FFM personality traits are considered to be fairly stable. The fact that all participants were 22 years in Study I and III could constitute a possible limitation, because the personality traits are not

thought to be fully stabilized at that age. Conversely, this tight age span could help in avoiding age- and generation- dependent effects on the findings. No data on asthma severity were collected in any of the studies, which could be a weakness, because degree of severity may influence adherence behaviour, perceptions of asthma control and HRQL. Another feasible limitation may be the method of measuring adherence using an indirect measure like self-reports,[85] owing to its potential weakness in terms of recall bias[40] and desirability bias,[85, 86] which could result in erroneously high scores.[86] Due to the study designs, self-report was considered the most feasible method of capturing adherence behaviour, although it did not provide an exact measure of adherence to prescribed medication treatment.

In qualitative research, rigour involves credibility, auditability and fittingness. Credibility concerns the trustworthiness of the findings, that is, whether the phenomenon under investigation is described in a recognizable manner for people versed in the area.[158] In Study III, credibility was considered by carrying out the initial interviews in a rather unprejudiced fashion and letting the participants talk freely about their medication intake. Using this approach, the participants directed the interview process and were not forced in a given direction. Constant openness was strived for during the collection and analysis of the data to achieve a balance between theoretical sensitivity[134] and reflexivity.[159] A constant comparison of data was conducted, in that ideas arising from the analysis were reconfirmed during subsequent collection of new data. Non-confirmed ideas could thereby be discarded. This policy was adhered to throughout the study, also in relation to data at more abstract levels, such as formulated concepts and categories, which were validated in subsequent interviews.[134] Auditability refers to the consistency of the study, that is, whether another researcher is able to follow the process. In the present study, auditability was considered through a careful description of the stages in the process, from selection of participants to data collection, and finally to the emergence of the theoretical model. Fittingness denotes the usefulness of the findings in a similar context. To enable judgment of fittingness, background data on the participants were accounted for, such as age and disease duration. It is also important to state the level of the generated theory to enable judgment of fittingness.[158] The theoretical model that was developed on the basis of the present data could be viewed as being on the level of a substantive theory, because it originates from a very specific context and therefore is not transferable to other contexts.[134]

Implications for future studies

The four studies forming the foundation of the present thesis are explorative in design. Thus one implication for future research is to enable the development and initiation of interventions based on the present findings for evaluation in clinical practice. One priority is to obtain accurate estimations of adherence behaviour, but also to identify patients who are in need of support with their adherence behaviour and to recognize what kind of support they might need. For example, one approach could be to intervene in low scorers on Conscientiousness by incorporating routines for medication intake to increase their adherence and by estimating effects on HRQL.

It has been argued that standardized and valid questionnaires for assessing adherence are rarely used in daily practice in clinical settings. Furthermore, in the context of clinical practice, it may be difficult to estimate accurate adherence level and to identify which patients are likely to deviate from a prescribed treatment.[85] Therefore, we suggest the development and validation of a practical questionnaire for clinical use based on the present findings, which both estimates adherence behaviour and identifies patients in need of support. Such a questionnaire may facilitate the adherence duty for health-care professionals and in turn be beneficial for the patients.

We also propose that the concept of adherence be further analysed and studied, as adherence behaviour in medication users is obviously guided by other motives than simply following a prescription. Because the theoretical model of adherence behaviour in Study III was based on a homogenous group of participants, it has limited fittingness. Therefore, understanding adherence reasoning in groups of various ages and undergoing different medication treatments would seem to be a reasonable approach to achieving better explanatory power. Studies of that kind could be of value in developing the concept “medication tactics” for clinical use.

In future studies, we recommend that self-reported adherence be combined with other more objective methods of monitoring, which result in more exact adherence scores.

We also propose that interventions to improve HRQL in persons living with chronic disease be further investigated, because reinforcement of self-efficacy and improvement of adherence to medication could be suitable for some, but not suitable as a general method.

The interaction of personality traits in relation to adherence behaviour deserves a more thorough investigation, the hope being that results might make it possible to identify personality profiles that require special attention and assistance from health-care professionals.

Clinical implications

The transition from disease-oriented care to a patient-centred[160, 161] or person-centred approach[162] aimed at shared treatment decisions can be assumed to challenge and encourage care-providers to increase both their interest in and knowledge of the diversity of personality differences. The present thesis offers insights into how different personality traits may influence adherence behaviour and perceptions of health outcomes, such as asthma control and HRQL. The present findings could help health-care professionals increase their understanding of patients' individual needs, but also serve as a guideline for how to approach assisting patients with disease management. For instance, a patient greatly influenced by Impulsivity – which in Study I was associated with reported poor asthma control, low HRQL, poor adherence and smoking– may need a different kind of support than a patient less influenced by this trait.

Conclusion

The present findings show that personality is an influential factor as regards adherence behaviour, self-efficacy, asthma control and HRQL. Because the stable biological personality dispositions have an impact on the Characteristic Adaptations, which in turn include changeable habits and attitudes, specifically targeted interventions could influence medication habits. These kinds of interventions would seem to be most needed among high scorers on Neuroticism and low scorers on Agreeableness and Conscientiousness. Supporting less agreeable and less conscientious people in their adherence behaviour could also result in a positive outcome in terms of their mental well-being. Reinforcing self-efficacy in low scorers

on Extraversion, Openness to experience and Conscientiousness could be beneficial to their mental well-being.

Overall, the present thesis identifies potential unmet needs in people with different personality dispositions and therefore could be viewed as an important contribution to the area of person-centred care. One reasonable conclusion is that increased knowledge and understanding of how different personality traits and motivational factors seem to influence adherence behaviour contribute greatly to the development of individually tailored approaches and treatment plans, designed to target the specific needs of each person, because no single adherence intervention fits everyone.

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“Stor är människans strävan,
stora de mål hon satt –
men mycket större är människan själv
med rötter i alltets natt.”

(Människans mångfald ur De sju dödssynderna av Karin Boye)

Svensk sammanfattning

Följsamhet med läkemedelsbehandling vid flertalet kroniska sjukdomar betraktas generellt sett som låg. Tidigare forskning har identifierat en rad påverkansfaktorer, men betydelsen av personlighet anses inte tillräckligt studerad. Personlighet kan beskrivas som psykologiska kvaliteter som bidrar till bestående och distinkta mönster, vilka visar sig i människors tankar, känslor och beteenden. Enligt fem-faktor modellen kan personlighet beskrivas mot bakgrund av fem breda, bipolära personlighetsdrag: *känslomässig instabilitet, utåtriktning, öppenhet, vänlighet* och *målmedvetenhet*. Dessa personlighetsdrag utgör den högsta hierarkiska nivån och vart och ett av dem är i sin tur uppdelade i sex s.k. facetter bestående av mer specifika personlighetsdrag. Avhandlingens övergripande syfte var att undersöka betydelsen av personlighet i förhållande till följsamhet med läkemedelsbehandling, astmakontroll, livskvalitet och tilltro till egen förmåga. Avhandlingen utgörs av fyra studier, vilka samtliga vilar på epidemiologisk grund. I Studierna I och III bestod deltagarna av unga vuxna, som var 22 år (+/- 1 år) och hade astma. Antalet deltagare var 268 i Studie I och 18 i Studie III. Studierna II och IV bestod av deltagare i åldrarna 30-70 år med olika typer av kroniska sjukdomar. Antalet deltagare var 749 i Studie II och 786 i Studie IV. I Studierna I, II och IV skedde datainsamlingen via frågeformulär. När det gäller skattning av personlighet användes två olika frågeformulär. I Studierna II och IV användes ett frågeformulär som skattar personlighetsdragen i fem-faktor modellen. I Studie I användes ett annat frågeformulär, vilket skattar hälsorelevanta facetter baserade på fem-faktor modellen. Studie III var en intervjustudie, vilken genomfördes enligt Grounded Theory metodologi.

Föreliggande avhandling visar att personlighetsdragen *känslomässig instabilitet, vänlighet* och *målmedvetenhet* verkar vara särskilt betydelsefulla i förhållande till följsamhet med läkemedelsbehandling. *Känslomässig instabilitet* hade ett negativt samband med följsamhet, vilket innebär att personer som skattade högt på detta personlighetsdrag rapporterade sämre följsamhet. Både *vänlighet* och *målmedvetenhet* hade positiva samband med följsamhet, vilket innebär att personer som skattade högt på dessa personlighetsdrag rapporterade högre följsamhet (Studie II).

När det gäller de hälsorelevanta facetterna identifierades negativa samband mellan *impulsivitet* och följsamhet. Dessutom framkom negativa samband mellan *alexitymi* och *antagonism* hos män och följsamhet, vilket indikerar att män som skattade högt på någon av dessa hälsorelevanta facetter tenderade att vara mindre följsamma med ordinerad astmamedicinering (Studie I). Vidare framkom att följsamhet med astmamedicinering verkar regleras av olika kognitiva motiverande fokus: *främjande fokus*, *förebyggande fokus* och *tillåtande fokus*. Dessa gav upphov till olika medicintaktiker, vilka samtliga syftade till att uppnå *en fungerande dag med astma* (Studie III).

När det gäller personlighet i förhållande till självskattad astmakontroll befanns den hälsorelevanta facetten *negativ affekt* ha ett negativt samband med astmakontroll, vilket innebär att personer som skattade högt på *negativ affekt*, skattade sämre astmakontroll. Beträffande mental hälsorelaterad livskvalitet, identifierades både *negativ affekt* och *impulsivitet* som negativa prediktorer, vilket innebär att ju högre personen skattade sig på dessa hälsorelevanta facetter desto lägre mental livskvalitet uppfattade sig personen ha (Studie I). Därtill visades att både *utåtriktning* och *målmedvetenhet* hade en indirekt effekt på mental hälsorelaterad livskvalitet genom tilltro till egen förmåga. Detta kan innebära att en förbättring av tilltro till egen förmåga skulle kunna öka den mentala hälsorelaterade livskvaliteten hos personer som skattar lågt på något av dessa personlighetsdrag. Vidare skulle såväl den fysiska som den mentala hälsorelaterade livskvaliteten kunna förbättras hos personer som skattar lågt på *öppenhet*, genom att stärka deras tilltro till egen förmåga. Den mentala livskvaliteten verkar även kunna förbättras hos personer som skattar lågt på *vänlighet* och *målmedvetenhet*, genom att öka deras följsamhet med läkemedelsbehandling (Studie IV).

Föreliggande avhandling identifierar möjliga behov hos människor med olika framträdande personlighetsdrag och skulle därför kunna utgöra ett betydelsefullt bidrag till utformandet av personanpassade interventioner med syfte att utveckla vård och behandling. En rimlig slutsats är att ökad kunskap och förståelse om betydelsen av olika personlighetsdrag och kognitivt motiverande faktorer i förhållande till följsamhet med läkemedelsbehandling och hälsoutfall som astmakontroll och hälsorelaterad livskvalitet kan bidraga till utveckling av skräddarsydda behandlingsplaner, designade för att tillgodose enskilda personers behov av stöd och tillvarata deras resurser.

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